A Consideration of Uncertainty in Sediment Risk Assessments. Todd Bridges, US Army Engineer Research and Development Center, and Katherine von Stackelberg, Menzie-Cura & Associates, Inc.

The importance and role of uncertainty in a risk assessment is strongly related to the complexity of the assessment and the governing environmental processes at the site of concern. For a number of reasons risk assessments for contaminated sediments pose several technical challenges which increase the importance of addressing uncertainty during the conduct of a risk assessment. Aquatic systems are both physically complex and dynamic. The interaction between geochemical, biological and hydraulic processes in aquatic systems produces steep spatial gradients in the variables controlling contaminant partitioning and transport and these processes are subject to sweeping temporal changes. These facts pose significant challenges to those tasked with describing exposure and effects for contaminated sediments using available modeling tools. Modeled predictions of ecological risks from exposure to contaminated sediments are uncertain. However, the degree to which this uncertainty is acknowledged, understood and explicitly described varies considerably among sediment risk assessments. A portion of this uncertainty is attributable to population heterogeneity, or variability, and the remainder to incertitude or ignorance resulting from a lack of understanding of the governing processes and associated data. Variability cannot be reduced, only better understood, while more information can be collected to reduce uncertainty arising from incertitude or ignorance. Because sediments are hydrodynamically transported and understanding of how aquatic biota move in and out of particular exposure zones as determined by species-specific behavior is limited, uncertainties tend to be greater for sediment risk assessments and those conducted in terrestrial environments. This makes uncertainty analysis particularly important when quantifying risks for sediment-based food webs. In this talk, we will first present a summary of our analysis of major sources of uncertainty in assessments of contaminated sediments and their management. We will then provide several examples of uncertainty analysis applications and modeling tools that have been developed to quantitatively evaluate sources of uncertainty in sediment risk assessments. These examples will include a description of a two-dimensional Monte Carlo bioaccumulation model that incorporates migratory and foraging characteristics of aquatic biota.